

What is Claimed

1. A process for heat treating components in an atmospheric heat treating furnace comprising the steps:

- (a) treating a component in an atmospheric furnace with a treating gas;
- (b) feeding the heat treated component containing the treating gas into a quenching chamber;
- (c) feeding a quenching gas into the quenching chamber to contact the treated component and mix with the treating gas;
- (d) feeding the quenching gas and treating gas of step (c) into a gas recovery chamber where the treating gas and quenching gas are separated to provide a purified quenching gas;
- (e) feeding the purified quenching gas of step (d) back into the quenching chamber; and
- (f) removing the cooled treated component from the gas quenching chamber.

2. The process of claim 1 wherein the atmospheric furnace is a carburizing atmospheric furnace and the treating gas is selected from the group comprising methane, carbon monoxide, hydrogen, nitrogen, pentane and butane.

3. The process of claim 1 wherein the quenching gas is at least one gas selected from the group comprising helium as the major component and one gas selected from the group comprising nitrogen, hydrogen, argon and carbon dioxide.

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4. The process of claim 1 wherein the treating gas is heated to a temperature between about 750°C and about 1200°C.

5. The process of claim 4 wherein the treating gas is endothermic gas.

6. The process of claim 1 wherein the quenching gas is pressurized to a pressure between about 37 psia and about 890 psia.

7. The process of claim 2 wherein the quenching gas is at least one gas selected from the group comprising helium, nitrogen, argon and carbon dioxide.

8. An apparatus for the treatment of components by a gas in a furnace comprising a furnace adapted for receiving treating gas and a component to be gas treated; said furnace coupled to a quenching chamber which is adapted for receiving the treated component from the furnace and the quenching gas; said quenching chamber coupled to a gas recovery device adapted for receiving the spent treating gas and the quenching gas and having means for separating the gases to provide a purified quenching gas; said gas recovery device adapted for transmitting the purified gas into the quenching chamber; and said apparatus operable such that quenching gas can be recycled between the quenching chamber and the recovery device.

9. The apparatus of claim 8 wherein the furnace is an atmospheric furnace.

10. The apparatus of claim 8 wherein the gas recovery device comprises a membrane adapted for purifying the quenching gas.

11. The apparatus of claim 8 wherein the gas recovery device comprises a molecular sieve.

12. The apparatus of claim 10 wherein hydrogen analyzing means are coupled to the recovery device for monitoring the hydrogen in the purified gas; oxygen feed means are coupled to the quenching chamber; and control means are coupled between said hydrogen analyzing means and oxygen feed means for controlling the feed of oxygen depending on the analysis of the hydrogen in the purified gas.

13. The apparatus of claim 10 wherein at least one compressor is coupled between its quenching chamber and the gas recovery device and said compressor being adapted to pressurize the purified quenching gas.

14. The apparatus of claim 13 wherein a catalyst bed is coupled between the compressor and the quenching chamber.

15. The apparatus of claim 9 wherein at least one compressor is coupled between its quenching chamber and the gas recovery device and said compressor being adapted to pressurize the purified quenching gas.

16. The apparatus of claim 10 wherein at least one compressor is coupled between its quenching chamber and the gas recovery device and said compressor being adapted to pressurize the purified quenching gas.